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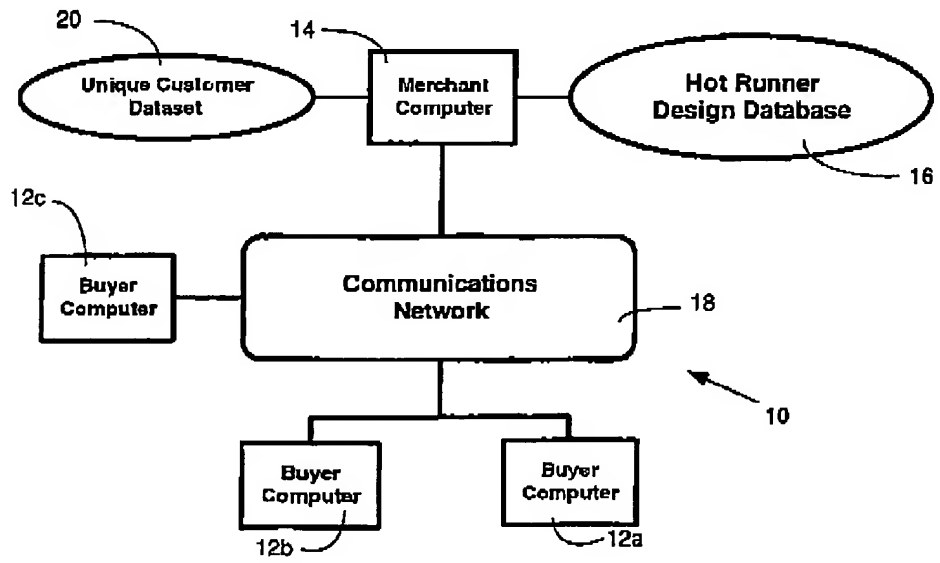
(54) Title: METHOD AND APPARATUS FOR CONFIGURING, ORDERING AND MANAGING THE FABRICATION IN A FACTORY OF AN INJECTION MOLDING MACHINE APPARATUS USING A DISTRIBUTED COMPUTING SYSTEM



(57) Abstract: A complete system for the online design and purchasing of an injection molding machine apparatus is presented. At least one merchant computer is connected to at least one buyer computer over a communications network whereby a buyer can selectably design and place an order an injection molding machine apparatus. Improved means for storage and sharing of design information of the machine apparatus is presented which results in reduced fabrication cycle time and improved quality and on time delivery.

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METHOD AND APPARATUS FOR CONFIGURING, ORDERING AND MANAGING THE FABRICATION IN A FACTORY OF AN INJECTION MOLDING MACHINE APPARATUS USING A DISTRIBUTED COMPUTING SYSTEM

TECHNICAL FIELD

The Internet, which started in the late 1960s, is a vast computer network consisting of many smaller networks that span the entire globe. The Internet has grown exponentially, and millions of users ranging from individuals to corporations now use permanent and dial-up connections to use the Internet on a daily basis worldwide. The computers or networks of computers connected within the Internet, known as "hosts", allow public access to databases featuring information in nearly every field of expertise and are supported by entities ranging from universities and government to many commercial organizations.

BACKGROUND OF THE INVENTION

The information on the Internet is made available to the public through "servers". A server is a system running on an Internet host for making available files or documents contained within that host. Such files are typically stored on magnetic storage devices, such as fixed disks, local to the host. An Internet server may distribute information to any computer that requests the files on a host. The computer making such a request is known as the "client", which may be an Internet-connected workstation, bulletin board system or home personal computer (PC).

TCP/IP (Transmission Control Protocol/Internet Protocol) is one networking protocol that permits full use of the Internet. All computers on a TCP/IP network need unique ID codes. Therefore, each computer or host on the Internet is identified by a unique number code, known as the IP (Internet Protocol) number or address, and corresponding network and computer names. In the past, an Internet user gained access to its resources only by identifying the host computer and a path through directories within the host's storage to locate a requested file. Although various navigating tools have helped users to search resources on the Internet without knowing specific host

addresses, these tools still require a substantial technical knowledge of the Internet.

The World-Wide Web (Web) is a method of accessing information on the Internet which allows a user to navigate the Internet resources intuitively, without IP addresses or other technical knowledge. The Web dispenses with command-line utilities which typically require a user to transmit sets of commands to communicate with an Internet server. Instead, the Web is made up of hundreds of thousands of interconnected "pages", or documents, which can be displayed on a computer monitor. The Web pages are provided by hosts running special servers. Software which runs these Web servers is relatively simple and is available on a wide range of computer platforms including PC's. Equally available is a form of client software, known as a Web "browser", which is used to display Web pages as well as traditional non-Web files on the client system. Today, the Internet hosts which provide Web servers are increasing at a rate of more than 300 per month, en route to becoming the preferred method of Internet communication.

Created in the early 1990s, the Web is based on the concept of "hypertext" and a transfer method known as "HTTP" (Hypertext Transfer Protocol). HTTP is designed to run primarily over TCP/IP and uses the standard Internet setup, where a server issues the data and a client displays or processes it. One format for information transfer is to create documents using Hypertext Markup Language (HTML). HTML pages are made up of standard text as well as formatting codes which indicate how the page should be displayed. The Web client, a browser, reads these codes in order to display the page.

Each Web page may contain pictures and sounds in addition to text. Hidden behind certain text, pictures or sounds are connections, known as "hypertext links" ("links"), to other pages within the same server or even on other computers within the Internet. For example, links may be visually displayed as words or phrases that may be underlined or displayed in a second color. Each link is directed to a web page by using a special name called a URL (Uniform Resource Locator). URLs enable a Web

browser to go directly to any file held on any Web server. A user may also specify a known URL by writing it directly into the command line on a Web page to jump to another Web page.

The URL naming system consists of three parts: the transfer format, the host name of the machine that holds the file, and the path to the file. An example of a URL may be:

http://www.sitename.com/Adir/Bdir/Cdir/page.html,

where "http" represents the transfer protocol; a colon and two forward slashes (://) are used to separate the transfer format from the host name; "www.sitename.com" is the host name in which "www" denotes that the file being requested is a Web page; "/Adir/Bdir/Cdir" is a set of directory names in a tree structure, or a path, on the host machine; and "page.html" is the file name with an indication that the file is written in HTML.

Therefore, with the click of the mouse, a user can be presented with information as well as a chance to collaborate with that information. The power of the web is the ability to share information instantaneously around the world and to allow users to interact with this data. Before the web, collaborative communication was either by phone or face-to-face. The web allows interactive collaboration at reduced cost and considerable time savings. Many web sites exist today that allow a user to search through an online catalog and order common retail products like music CDs, books and flowers. These sites are not truly collaborative because the product is already fully configured and ready for purchase.

Within the plastics industry, a company that has developed a new plastic product will need to purchase an injection molding machine apparatus to injection mold this new product for the product's release. Based on the plastic product's design, the company establishes specific requirements that the molding machine must meet. These requirements include not only machine performance, but will also include machine cost, delivery time, maintenance cost and the like.

Matching the requirements the plastics company has established to a machine is often a time consuming and laborious process due to the many factors that must be analyzed to arrive at a final machine configuration. For example, a typical set of machine parameters that must be considered in choosing an injection molding machine include part size, resin type, mold design, and desired machine throughput to name just a few.

Following what may be weeks of face-to-face and phone collaboration between the injection molding machine manufacturer and the customer, a machine configuration is agreed upon and a machine is placed on order. Typical delivery times for an injection molding machine can vary greatly depending on the size and complexity of the machine. Specifically, according to the prior art, custom hot runner systems can be delivered in 8-10 weeks. This long lead time is often not acceptable for many customers and the industry is currently under pressure to reduce this lead time to 3-4 weeks.

Once an order is placed, numerous documents are created to facilitate the building of the machine. These documents are typically stored both electronically in computer systems as well as in hard copy format. These documents can include Computer Aided Drawings (CAD) of the machine configuration, sales contract, schedules, bill of materials (BOM), inspection reports, change reports, shipping records, etc. If the buyer of the machine would like access to any of these documents, typically they will contact the manufacturer and obtain hard copies of the documents. This method of information sharing has proven time consuming and prone to errors.

Following the placing of the order, changes may occur in the machine configuration based on customer input. Due to the disparate computing environments currently being used, managing changes to the machine configuration is extremely difficult and prone to error. Errors in the machine configuration often result in rework and delays in delivery to the customer. Errors can occur at many points along the communication chain. The customer may provide erroneous information due to an internal

error. The manufacturer may misinterpret the change request and incorrectly change the configuration of the machine. Often a change that was requested never made it into the machine configuration paper work and therefore the requested change was never implemented. There are many potential sources for error due to the current mode of communication between manufacturer and customer.

To track progress, a customer often requests periodic updates of when the machine is expected to arrive at their factory. Reporting status back to the customer is also very time consuming and error prone. Tracking progress of an order as it progress through the factory requires manually tracking where the order is in the overall process.

Often, a customer may need CAD drawings of the machine they have ordered so they may order other products that interface with the machine. These CAD drawings are created by the machine manufacturer and are provided to the customer some time after the order is placed. Each time a change is made to the machine, these drawings are manually updated and delivered to the customer for approval and acceptance. This manual process results in errors, delivery delays and increased cost.

Therefore, an improved system and method is needed that utilizes the collaborative power of the web and other internet based technologies to facilitate the configuration, ordering and tracking of an injection molding machine apparatus.

SUMMARY OF THE INVENTION

The primary objective of the invention is to provide an online collaborative system for the configuring, ordering and status reporting of an injection molding machine apparatus.

Another object of the invention is to provide an online means for communicating configuration changes to an injection molding machine apparatus from a customer to the manufacturer.

A further object of the invention is to provide an

interactive web site where a customer can configure and order an injection molding machine apparatus without the need for offline collaboration.

Still another object of the invention is to provide an online system for requesting changes to an already ordered injection molding machine apparatus.

Still a further object of the invention is to provide an online system that allows customers to generate a set of CAD drawings of an injection molding machine apparatus based on the customers selected configuration.

Still another object of the invention is to provide an online system for obtaining up-to-date status and delivery information of a previously ordered injection molding machine apparatus.

Yet another object of the invention is to provide an online collaborative system that reduces errors in the communication of changes to a machine configuration.

Still another object of the invention is to provide an online collaborative system that reduces the time required to fabricate an injection molding machine apparatus.

The foregoing objects are achieved in an arrangement comprising a plurality of computers connected to a digital computer network, the network carrying and routing digital information between the computers. At least one of the computers is an internet based server which contains a database of injection molding machine apparatus design information. The server communicates over the network to a plurality of buyer computers to provide a collaborative computing environment where a buyer can easily configure and order an injection molding machine apparatus without the need for extensive person to person collaboration. Once the customer has fully configured the injection molding machine apparatus a purchase order for the fully configured injection molding apparatus is generated by the customer while online.

Based on the customer's selected configuration, the server generates a dataset that includes the ordered machine's CAD files, financial information, bill of material and fabrication status that may be easily viewed online by the customer. Each order will be assigned a unique order number that will allow a customer to securely review status and design documentation as well as submit changes and/or questions to the machine manufacturer using a computer connected to a server over a computer network.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a simplified schematic diagram of the invention;

FIG. 2 is a simplified block diagram representing the elements of a typical injection molding apparatus design database, specifically directed towards a hot runner;

FIG. 3 is a simplified block diagram representing the elements that comprise an order dataset;

FIG. 4, 4a, 4b, 4c, 4d is a series of simplified flow diagrams of the online interactive computer system directed towards a hot runner;

FIG. 5 is a simplified flow diagram showing the online configuration and collaborative design process for an injection molding machine apparatus directed towards a hotrunner subsystem;

FIG. 5a is a continuation of the simplified flow diagram showing the online configuration and ordering system;

FIG. 6 is a flow diagram of the off-line prior art method of ordering a hot runner subsystem and its associated timeline;

FIG. 7 is a flow diagram of the online configuration and ordering of a hot runner subsystem and its associated reduced timeline over the prior art;

FIG. 8 is a isometric view of a typical hot runner subsystem.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

The present invention will be described in the context of the exemplary internet based hot runner design and ordering system 10 shown in FIG. 1. Since the majority of the detailed specification will concentrate on the online design and configuring of an injection molding hot runner subsystem, a simplified view of a hot runner is provided in FIG 8.

The hot runner subsystem comprises a heated hot runner manifold 158 sandwiched between an insulator board 146 and a mold base 132. The subsystem further includes a plurality of nozzle assemblies 142 which interface with melt channels within the heated manifold 158 to deliver molten plastic to a mold or cavity (not shown). A sprue bushing 150 is inserted through the insulator board 146 and interfaces with the manifold 158 for communication of molten plastic from the injection molding machine (not shown). An electrical connector 130 is attached to the mold base 132 to provide power to a manifold heater 160 which maintains the plastic in a molten state when flowing through the manifold 158. The distance between nozzle assemblies 142 is known as the nozzle pitch 138. A locating ring 147 is mounted to a face of the insulator board 146 around the sprue bushing 150 which helps maintain alignment between the hot runner subsystem and the injection machine (not shown). A plurality of locating pins 143 protrude from the face of the mold base 132 to help maintain alignment of the hot runner subsystem with the cavity mold (not shown). A thermocouple 131 is mounted in the manifold 158 and measures the temperature of the manifold 158 during the injection molding process. The thermocouple's electrical power and the return signal are provided through the electrical connector 130.

Referring to FIG. 8, the operation of a hot runner will now be described. Molten plastic flows from the injection molding machine (not shown) into the sprue bushing 150. The molten

plastic flows through the sprue bushing 150 to the channels located in the manifold 158. The manifold 158 is maintained at an elevated temperature by a manifold heater 160 which is embedded in the surface of the manifold 158 to maintain the plastic in a molten state. As the molten plastic flows through the channels of the manifold 158, the flow splits so that an equal amount of molten material is delivered to each nozzle assembly 142. The molten plastic then flows through each nozzle assembly 142 and into a respective mold/cavity (not shown). While FIG. 8 depicts a hot runner subsystem with two nozzle assemblies 142, it is not uncommon to have much larger systems that contain forty-eight or ninety-six such nozzle assemblies.

A networked design and configuration system 10 as shown in FIG. 1 employs a communications network 18 to interconnect a plurality of buyer computers 12a, 12b, and 12c for example to at least one merchant computer 14. The merchant computer 14 contains a hot runner design database 16 and the digital storage of unique customer datasets 20. A user of the system employs a buyer computer 12 to retrieve information from the hot runner design database 16 and create a new unique customer dataset 20 for storage on the merchant computer 14. The unique customer dataset 20 contains a complete set of digital documents that would comprise and define a hot runner configuration and purchase request.

Now referring to FIG. 2, in a hot runner design database 16, various design parameters are stored separately for selection by a customer. In a typical hot runner subsystem, the design parameters that must be configured so that it interfaces with the overall injection molding machine include as a minimum a locating ring interface 32, a sprue bushing interface 30, a platen mounting method 28, nozzle locations 26, mold plate compatibility parameters 24, a valve gate style parameter 22 and an electrical connection interface 21. With the selection of the above design parameters, the design and configuration of a hot runner subsystem can be fully designed and the merchant computer 14 may initiate the creation and storage of the unique customer dataset 20.

Referring to FIG. 3, a unique customer dataset 20 is generated by the merchant computer 14 based on the selections transmitted by at least one buyer computer 12. In a typical customer dataset 20 a digital CAD file 50 is stored that describes the engineering design of the instant hot runner for downloading or online viewing. Also included in the customer dataset 20 is a digital bill of materials 52 which lists the quantities and descriptions of every discrete part that make up the instant hot runner. Once the customers hot runner is configured, it is possible to prepare a schedule 54 which shows each discrete step and the estimated time duration for each step in the hot runner manufacturing process. This schedule 54 may be continually updated based upon changes that may occur following the original order entry. The schedule 54 may be stored in a digital file thereby allowing easy online viewing, downloading or printing.

In the event a customer or the merchant needs to request a change to the hot runner configuration, a change request 56 would be generated which would document the specifics surrounding the required change. Managing the changes that occur to a specific order has always been a troublesome process due to the many opportunities for mis-communication of the requested change. Providing a central location and the digital storage of these change request 56 will insure instant and consistent communication of the required change.

Other digital documents that make up a customer dataset 20 further comprise a purchase order 58, a sales contract 60, a sales agreement 62, and a statement of work 72. Each of these digital documents are used to define the legally specific relationship and agreement between the merchant and the buyer. These documents will be automatically generated based upon the buyer's selections during the ordering process. With recent US laws enacted that allow for legally binding contracts to be entered using digital signature technology, optionally a buyer could employ such technology to sign and consummate the order of the hot runner completely online. In the alternative, the documents may be printed out, signed and then computer scanned and saved as computer readable image files.

During the manufacturing of the hot runner subsystem, buyers frequently require status updates to determine if everything is on schedule. Included in the customer dataset 20 is a status report 64 that is constantly updated to show the current status of the item placed on order as it goes through the various stages of the manufacturing process. This status report 64 may be readily compared to the original schedule 54 to determine if corrective action is required due to a schedule slip. The status report 64 may be updated by shop floor personnel as the hot runner subsystem goes from manufacturing process to process. The online status report 64 provides instant feedback to the customer and reduces the burden placed on the merchant who, based on the prior art, must constantly prepare these status reports manually and are often out of date.

Through the course of manufacturing the hot runner subsystem, various inspections are performed to insure the item is manufactured in accordance with a product specification 70. Available on line for viewing, downloading or printing is a series of inspection reports 66 which indicate inspections that have been performed as well as any out of specification measurements or occurrences. In the event an inspection reveals an unacceptable condition, corrective action must be performed to place the item back into an acceptable condition. A corrective action report 68 would be generated and made available online if this occurs. The corrective action report 68 will include the methods employed to remedy the situation as well as the outcome of the corrective action.

Also include in the customer dataset 20 will be digital documents that indicate the financial status of the order. A financial account statement 74 will indicate payments received by the merchant from the buyer relative to that particular order. The financial account statement 74 may also include adjustments to the buyer account based on other events during the fabrication of the hot runner subsystem.

The online use of the customer dataset 20 is advantageous because it creates a central location or repository for all the

information that comprises an order, and allows quick and easy access for the buyer and the merchant. Using well known information management techniques, a buyer or merchant can also quickly parse out specific data from each customer dataset 20 and create a report to show status and items on a larger scale. For example, a customer who has multiple orders at the same time may wish to see an overall status report for all of these open orders in one convenient document. Database manipulation techniques may easily be employed while the buyer is online to generate such a report and provide the report to the buyer for online viewing, downloading or printing.

Referring to FIG. 4, 4a, 4b, 4c, and 4d, the online design and configuration process of a hot runner subsystem will now be described. A buyer computer 12 will connect with a merchant computer 14 over a communications network 18 (FIG. 4, item 300). The buyer computer 12 will typically employ a client browser program to view the data available on the merchant computer 14. The merchant computer 14 will typically employ an internet server program to respond to requests by the client browser program. The buyer computer 12 will have displayed a menu of choices which may be selected by the buyer, typically by the click of a mouse which is connected to the buyer computer 12. In the present invention, these menu of choices include a create new account option (FIG. 4, item 302), a place order/configure hot runner option (FIG. 4, item 318), a review orders option (FIG. 4, item 332) and a request change option (FIG. 4, item 348).

The first time a user connects to the merchant computer 14, they must create an account so they may enter an order. Selecting the create new account option (FIG. 4, item 302), the user is presented with a series of steps as shown in FIG. 4a. A new user will be required to submit basic contact information about themselves as well as the company they represent (FIG 4a, item 304). This information will be stored and used for all subsequent orders placed by this user and will include at a minimum a full name, company name, address, phone number, fax number and email address. The new user must select a unique username and password (FIG. 4a, item 306), which will be used to

identify the user and allow them to place orders, review orders and make change requests. The merchant computer 14 will verify that the username selected is not already in use and that the password is acceptable (FIG 4a, item 308). If the information provided is not acceptable, an error will be presented (FIG 4a, item 310a) to the buyer computer 12 and the user will be requested to try a different username and/or password. If the information is verified as acceptable, the new account will be created (FIG 4a, item 312) and the user will be presented with a confirmation screen (FIG 4a, item 314) to indicate that the username and password has been approved. In addition, and to create a more tangible record of the new account being created, a confirmation email (FIG 4a, item 316) will be sent to the user. Contained in the email will be the contact information the user provided while creating the new account. Once the account has been created, the user will be returned to the merchant computer's home page (FIG. 4, item 300)..

Once an account is created, a buyer may now configure and design a complete hot runner subsystem online. Selecting the configure hot runner option (FIG. 4, item 318) will cause the merchant computer 14 to generate and communicate with the buyer computer 12 a collection of steps which leads the buyer through a process to design and configure a hot runner subsystem. Referring to FIG. 4b, the buyer must sign in using the username and password previously created (FIG 4b, item 320). The merchant computer 14 will then validate an account exists for that username and the password is correct. The buyer may then start the steps of configuring a hot runner online (FIG 4b, item 322). The detailed steps required to design and configure a hot runner subsystem is described in FIG. 5 and FIG. 5a, and will be described hereinafter.

Once the design and configuration process as shown in FIG. 5 and 5a (described hereinafter) is completed, the order information is analyzed by the merchant computer (FIG 4b, item 324) to ensure all the necessary information has been provided and meets predetermined guidelines. If an error or problem is encountered during this analysis, an error screen is presented (FIG 4b, item 310b) and the buyer is requested to take

corrective action. Upon verification of the order information, an order ID will be generated and the data provided by the buyer will be used to generate the customer dataset 20 for this order. The customer dataset 20 will be generated almost instantly while the buyer is online and connected to the merchant computer 14. Once the customer dataset 20 is created, a confirmation of order screen will be presented to the user (FIG. 4b, item 328) which will identify the order number associated with this order as well as the pertinent information required to help the buyer identify this order. A confirmation email will also be sent to the buyer (FIG 4b, item 330) which will contain a set of predetermined order information. Upon completion of the ordering process, the user will be returned to the merchant computer's home page (FIG 4, item 300).

Once an order is placed by a buyer, that buyer may wish to review the order details that are contained in the customer dataset 20. Selecting the review orders option (FIG 4, item 332) will present the buyer with a series of steps as shown in FIG 4c. To review an order, the buyer must have already established an account (FIG 4, item 302) and placed an acceptable order (FIG 4, item 318). Selecting the review orders option (FIG 4, item 332), the buyer will be requested to sign in by entering their username and password (FIG 4c, item 334). The merchant computer 14 will verify the account information (FIG. 4c, item 336) and present the buyer with a list of open orders (FIG. 4c, item 338). If the password and username and not verified, an error will be displayed (FIG 4c, item 310c) and the user will be prompted to enter the correct information. Optionally, the list of open orders would include all the orders placed by this buyer rather than just the open orders. This would allow a buyer to search through historical information of previous orders which may be necessary for various technical and business related reasons.

The buyer may select the order they wish to review (FIG. 4c, item 340) by simply clicking on one of the items in the list of orders by using a mouse connected to the buyer computer 12. The merchant computer 14 would then transmit to the buyer computer 12 a list of available documents available for online

viewing (FIG 4c, item 342) that are associated with that order. The user selects the document for viewing (FIG 4c, item 344) by clicking on the item using the mouse. The merchant computer 14 then transmits to the buyer computer 12 the selected document where the user may further view online, download or print it (FIG. 4c, item 346). Following this, the buyer may choose to return to any of the earlier steps of displaying all open orders (FIG 4c, item 338), selecting an order to review (FIG 4c, item 340), or to display the order dataset (FIG 4c, item 342). Alternatively, the buyer can be returned to the merchant computer home page (FIG 4, item 300).

A buyer may need to make changes to the hot runner subsystem they have ordered. In the prior art, which uses a manual entry and response system, the management of these change requests is prone to costly errors. It is therefore advantageous to provide an online system that allows a buyer to make a change request online so that each change is easily tracked and implemented, thereby reducing the opportunity for error.

Referring to FIG. 4, a buyer who has previously created an account and placed an order for a hot runner subsystem may select a request change option (FIG. 4, item 348). This option will present the buyer with a series of steps that allow them to review the specifics of an order by reviewing the dataset 20, and then selectively requesting a change to the configuration of the hot runner subsystem. Referring to FIG. 4d, the buyer must first sign-in using their username and password (FIG 4d, item 334a). If the username and password is not verified, an error screen is displayed (FIG. 4d, item 310d) and the buyer is returned to the sign in screen (FIG. 4d, item 334a). The merchant computer 14, upon validating the username and password presents the buyer with a list of current open orders associated with their account (FIG 4d, item 338a). The buyer then selects the order that they wish to review by clicking on it with the mouse (FIG. 4d, item 340a). The dataset 20 associated with this order is then displayed which contains all the documents associated with the selected order (FIG. 4d, item 342a). The buyer may then request a change to the configuration of the hot

runner subsystem (FIG. 4d, item 350). To submit a change request, the buyer must supply detailed information that adequately describes the change. A buyer then submits the change request information to the merchant computer 14, and the merchant computer assigns a unique change request number and confirms receipt of the change request to the buyer (FIG. 4d, item 352).

The manufacturer will need to determine the impact to cost and schedule as a result of the change, and provide that information to the buyer for approval. Only if the buyer agrees with the cost and schedule impact will the change be implemented. Upon approval, the dataset 20 associated with this change will be updated to reflect the requested change. For historical record keeping, the original dataset 20 will remain in the online database in a separate dataset 20 in the event previous revisions need to be reviewed.

Now referring to FIG. 5, the steps required to configure and design a complete hot runner subsystem will be described. Selecting the configure hot runner option (FIG. 4, item 318) will present the buyer with a series of choices that will capture the design information for a typical hot runner subsystem (FIG 5, item 200). The first item the buyer must select is the number of drops, or nozzles the hot runner subsystem will need (FIG 5, item 202). Once the number of drops is determined, the pattern of the drops must then be selected (FIG. 5, item 204). In an effort to simplify the design process of the hot runner subsystem, a series of discrete patterns is made available. A graphical representation of each pattern is displayed on the buyer's computer 12 to facilitate the selection of the drop pattern. The drop pattern can range from a simple inline configuration to a more complex pattern with multiple branches.

Once the nozzle pattern is selected, the buyer will then select the nozzle type (FIG. 5, item 206). There are numerous nozzle types that are typically used on hot runner subsystems. Nozzle types include hot tip, valve gated, and sprue gating. Each type has its specific application and operating parameters and the

buyer will make this selection based on the design of the overall injection molding machine.

Once the nozzle type is selected, the buyer will then select the desired spacing between the nozzles (FIG. 5, item 208). The spacing between the nozzles is known as the nozzle pitch (FIG. 8, item 138) and a range of acceptable spacings are available to the buyer to interface with their mold design. The selected nozzle spacing must fall within a minimum and a maximum distance based upon the nozzle type selected. For example, using a hot tip type nozzle, the nozzles must be at least 2.362" apart. The merchant computer 14 will perform a check of the selected parameters to verify that the selected spacing is within the allowable limits (FIG. 5, item 210). If the selected nozzle spacing is not within the specified limits, the buyer will be returned (FIG. 5, item 218) to the nozzle selection screen (FIG. 5, item 206) and/or the drop spacing screen (FIG. 5, item 208). The next step for the buyer is to select the nozzle L-dimension (FIG. 5, item 211). The L-dimension is the distance the nozzle (FIG. 8, item 142) protrudes from the mold base (FIG. 8, item 132). The buyer is free to choose any L-dimension that may be required to interface with their mold design. The selection of this item in combination with the selection of the nozzle type (FIG. 5, item 206) will determine the thickness of the mold base (FIG. 8, item 132).

The buyer will now be required to select the mold base manufacturer from a pre-determined list (FIG. 5, item 212). Selecting the mold base manufacturer is required because each manufacturer follows their own specific design guidelines. Knowing the mold base manufacturer is required by the hot runner manufacturer in order to determine various mechanical interfaces between the mold base and the hot runner subsystem. The buyer is not required to know the specifics between the different mold base manufacturers because the merchant computer 14 stores this information and automatically configures the hot runner subsystem to interface with the mold base selected by the buyer. In the preferred embodiment, the mold base manufacturer is selected by a click of the buyer's mouse on a drop down list.

The next step in the online design process is for the buyer to select the units of measure used in the design of their injection molding system (FIG. 5, item 214). Since buyers of hot runner subsystems exist all over the world, some buyers will prefer their designs be represented in english units, and other buyers will prefer their designs be represented in metric units. The CAD files 50 will be generated using the units selected during this step.

The next step in the process requires the buyer to provide the length and width of the mold base they intend to use with the hot runner subsystem (FIG. 5, item 220). Since the available plate sizes are dependent on the mold base manufacturer previously selected (FIG. 5, item 212), a list of pre-determined plates sizes will be presented to the buyer that match those made by the selected mold base manufacturer. In the preferred embodiment, the buyer will select the plate size by clicking on an item in a drop down list.

Now referring to FIG. 5a, the next step in the online design process is the entering of various injection molding machine parameters (FIG. 5a, item 222). Typical inputs which adequately describe the injection molding machine will include the electrical interface details and mechanical interface details. Electrical interface details typically include the electrical connector interface (FIG. 8, item 130), the voltage of the machine which the hot runner subsystem will be connected to, and the thermocouple type (FIG 8, item 131).

The mechanical interface information will typically include the machine nozzle orifice diameter, the machine nozzle interface radius, the locating ring diameter (FIG. 8, item 147) and the thread type of the machine nozzle.

The next item the buyer must input is the mounting details of the hot runner subsystem to the injection molding machine (FIG. 5a, item 226). Currently there are two industry standard mount designs to attach a hot runner subsystem to the injection molding machine. The buyer selects this option based on the design of the injection molding machine and the hot runner

subsystem is configured to interface with the chosen design.

The next series of inputs by the buyer will describe the finished plastic part that is to be molded using the hot runner subsystem as well as the plastic resin that is to be used and the processing parameters such as molding temperature and pressure (FIG. 5a, item 224). The merchant computer 14 uses these inputs to calculate the diameter of the melt channel within the manifold (FIG. 8, item 158) and the nozzle (FIG. 8, item 142). For example, the buyer will need to supply the melt temperature, the mold temperature, the injection time, the injection pressure, the diameter of the nozzle outlet, and the melt flow index. All of these parameters in combination will be used by the merchant computer 14 to calculate the optimum diameter of the melt channel in the manifold (FIG. 8, 142). This calculated diameter will then be used in generating the CAD files (FIG. 3, item 50). Calculating an optimum diameter for the melt channel reduces pressure loss in the hot runner subsystem and helps to produce a superior quality part.

This is the last piece of design information necessary to design and configure a complete hot runner subsystem. The buyer will be presented with a one page datasheet that lists all the parameters they entered previously (FIG. 5a, item 230). At this point the buyer is given an opportunity to review and change any of the parameters entered. If the buyer would like to change the configuration, a simple point and click is all that is required to be taken back to that particular entry screen (FIG. 5a, item 240), and enter new values for those design parameters.

Once the buyer verifies all the information provided during the online design process, the buyer will confirm the order (FIG. 5a, item 232) and the merchant computer 14 will generate the dataset 20 for this particular hot runner subsystem (FIG. 5a, item 234) which will be identified by a unique order number.

An email confirmation will be delivered to the buyer (FIG. 5a, item 236) to acknowledge receipt of the order by the merchant computer 14. In addition, an email will be sent to the hot runner manufacturer (FIG. 5a, item 238)to notify them that a

hot runner subsystem has been designed and placed on order. The dataset 20 associated with this order will be immediately available for online viewing, downloading or printing.

Thus the reader can see that the present invention provides an improved online design system which reduces overall cycle time as well as reduces the chance for design and configuration errors of a machine designed online. Referring to FIG. 6 and FIG. 7, a comparison in cycle time of the present invention over the prior art is shown. FIG. 6 shows the prior art method of designing and ordering a typical hot runner subsystem. The first step in the process of designing a hot runner subsystem is mold concepts are developed by the buyer(FIG. 6 item 102 and FIG. 7 item 102a). This process usually requires at least 1-2 weeks of design activity by buyer's engineers to arrive at a final mold concept design. The present invention doesn't reduce the time for this process because it is largely done by the buyer as they are designing the finished part which is to be molded.

Based on the prior art, once the mold concept is developed, the buyer will spend several days supplying their mold design to the hot runner manufacturer in the form of CAD files and hard copies that describe the interface to the hot runner subsystem (FIG. 6, item 104). Usually transmission of this information is through the mail after all the documentation has been printed out and compiled. In comparison, the present invention reduces this time to the time it takes to click through the simple online process to define the hot runner subsystem interfaces (FIG.7, item 104a).

According to the prior art, following submission of the interface information to the hot runner supplier, and after some preliminary data checking (FIG. 6, item 108), the fabrication of that hot runner can begin(FIG. 6, item 110). According to the prior art, it is not uncommon for the fabrication of the hot runner to take 4 to 6 weeks due to errors and omissions that occur when the buyer supplies incorrect or confusing design information to the hot runner manufacturer. In contrast, the present invention provides all the pertinent design information

to the hot runner manufacturer in a concise and familiar format, thereby reducing errors which results in a cycle time of only 3 ½ weeks to fabricate the entire hot runner subsystem (FIG. 7, item 110a). Similarly, data verification in accordance with the present invention is reduced to just seconds because it is performed online by the merchant computer 14 while the buyer is designing the hot runner (FIG. 7, item 110a). Once the hot runner has been fabricated it is shipped to the customer (FIG 6, item 112 and FIG. 7, item 112a). As shown by the comparison of the total cycle time of the prior art of 8-14 weeks (FIG. 6, item 114) to the present invention of 4-6 weeks (FIG. 7, item 114a), significant time savings can be realized by the present invention over the prior art.

It is to be understood that the invention is not limited to the illustrations described and shown herein, which are deemed to be merely illustrative of the best modes of carrying out the invention, and which are susceptible of modification of form, size, arrangement of parts and details of operation. The invention rather is intended to encompass all such modifications which are within its spirit and scope as defined by the claims.

WHAT IS CLAIMED IS:

1. In an arrangement comprising plural computers connected to a digital communications network, said network carrying and routing digital information between said plural computers including at least one general purpose computer associated with at least one user, at least one merchant computer associated with at least one merchant, said general purpose computer having a display device and at least one user input device, the display device being capable of providing a visual display based at least in part on the digital information delivered to the general purpose computer via said network, said digital information including information from at least one database associated with at least one of said merchant computers, said database containing design parameters for at least one injection molding apparatus, said user being able to operate said user input device to select and activate a network connection to at least one said merchant computer, a method permitting the user to configure and order an injection molding apparatus, the method comprising:
   (1) supplying the user, via the general purpose computer, a choice of at least one design parameter for an injection molding apparatus, and allowing the user to select at least one said parameter by operating at least one user input device;
   (2) collecting at least one selected parameter from step (1) and communicating via the network said parameter to at least one said merchant computer;
   (3) at least one said merchant computer generating a dataset based on at least one said selected parameters from step (2) which is assigned a unique number for identification of said dataset.

2. The method according to claim 1, wherein said injection molding apparatus is a hot runner subsystem.

3. The method according to claim 1, further comprising the steps of supplying said user with said unique number wherein said user can selectably view said dataset via said general purpose computer.

4. The method according to claim 1, further comprising the steps of supplying said user with said unique number wherein said user can selectably modify said dataset via said general purpose computer.

5. The method according to claim 4, wherein said injection molding apparatus is a hot runner subsystem.

6. The method according to claim 1, wherein said dataset contains at least one digital document type selected from the group consisting of computer aided drawings, bill of materials, fabrication schedule, change requests, purchase order, sales contract, sales agreement, status report, inspection report, corrective action report, product specification, statement of work and financial account statement.

7. An online collaboration system for configuring and ordering an injection molding apparatus comprising:

communication between at least one buyer computer and at least one merchant computer over a digital communications network;

said merchant computer being programmed to store a database of injection molding apparatus design parameters;

said buyer computer programmed to use a browser program to search and view said database wherein said buyer computer selectably configures an injection molding apparatus using said database;

said buyer computer generates a purchase request for said injection molding apparatus which is communicated to said merchant computer over said communications network and stored in a memory location of said merchant computer;

said merchant computer generates a dataset based on said purchase request;

said merchant computer generates a unique identification number for said dataset and provides said number via said communications network to said buyer computer;

said buyer computer selectably views said dataset via said network utilizing said identification number to control access to said dataset; and

said buyer computer selectably communicates with said merchant computer changes to said dataset.

8. The online collaboration system of claim 7, wherein said injection molding apparatus is a hot runner subsystem.

9. A system for configuring and ordering an injection molding apparatus, including a computer system accessible for on-line interactive communication with users, said computer system comprising;

a first memory area for storing a product catalog, said product catalog including product descriptions and at least one set of design parameters for selectable configuration of said injection molding apparatus;

a second memory area for storing a dataset based on users selected parameters;

a unique identification number generated for each dataset.

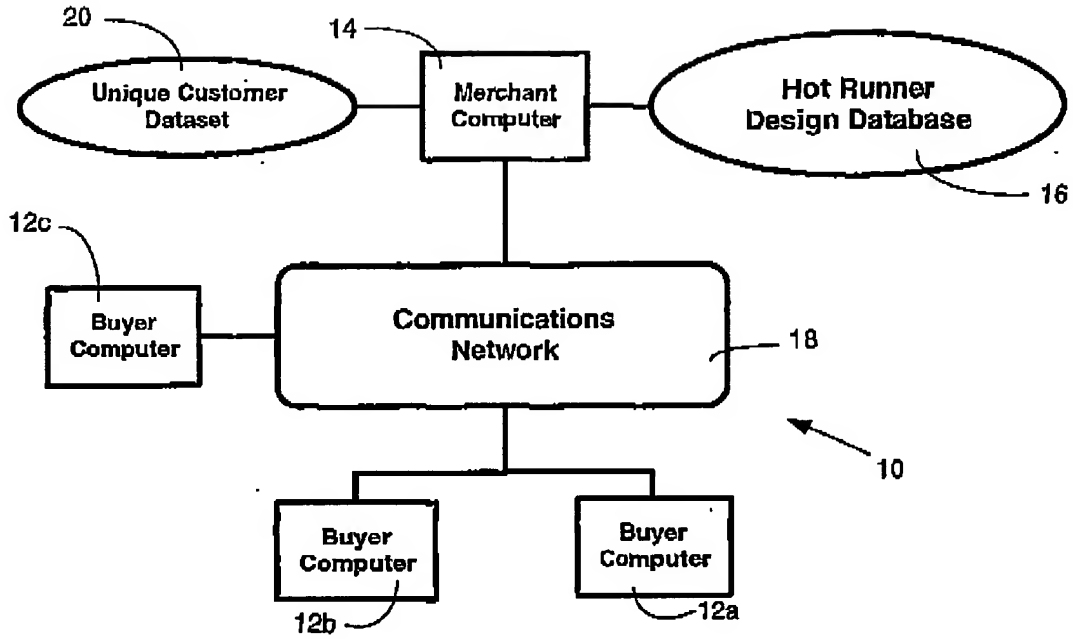
20
14
Unique Customer Dataset
Merchant Computer
Hot Runner Design Database
16
12c
Buyer Computer
Communications Network
18
10
Buyer Computer
Buyer Computer
12b
12a

FIG. 1

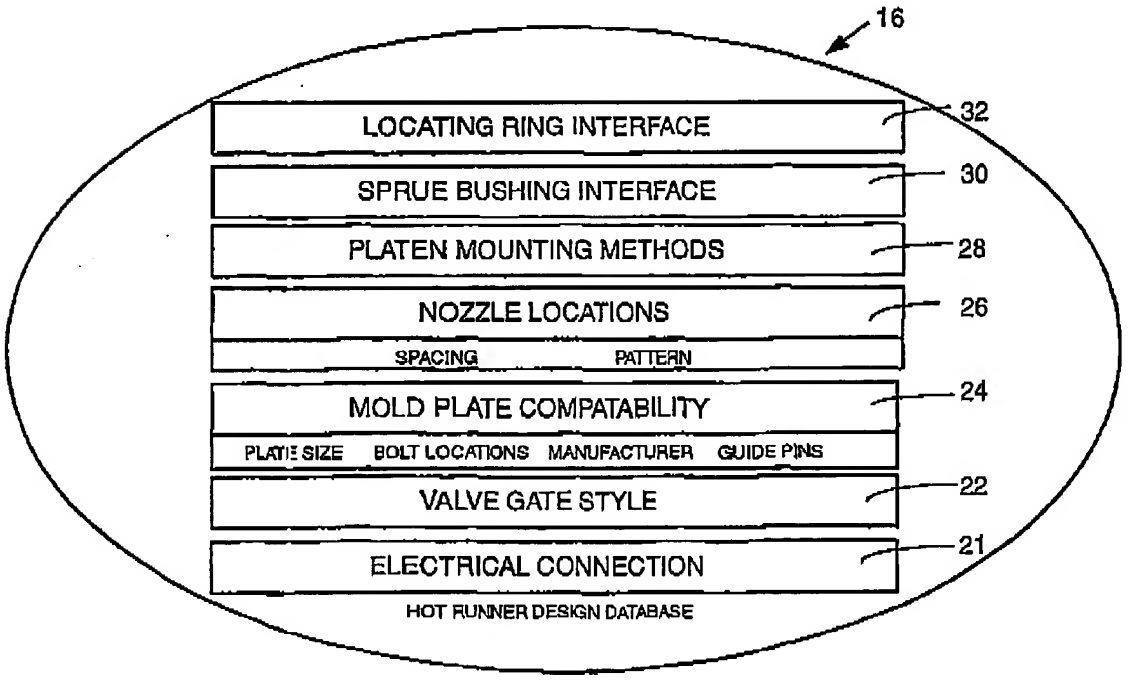
16
LOCATING RING INTERFACE
32
SPRUE BUSHING INTERFACE
30
PLATEN MOUNTING METHODS
28
NOZZLE LOCATIONS
26
SPACING
PATTERN
MOLD PLATE COMPATABILITY
24
PLATE SIZE
BOLT LOCATIONS
MANUFACTURER
GUIDE PINS
VALVE GATE STYLE
22
ELECTRICAL CONNECTION
21
HOT RUNNER DESIGN DATABASE

FIG. 2

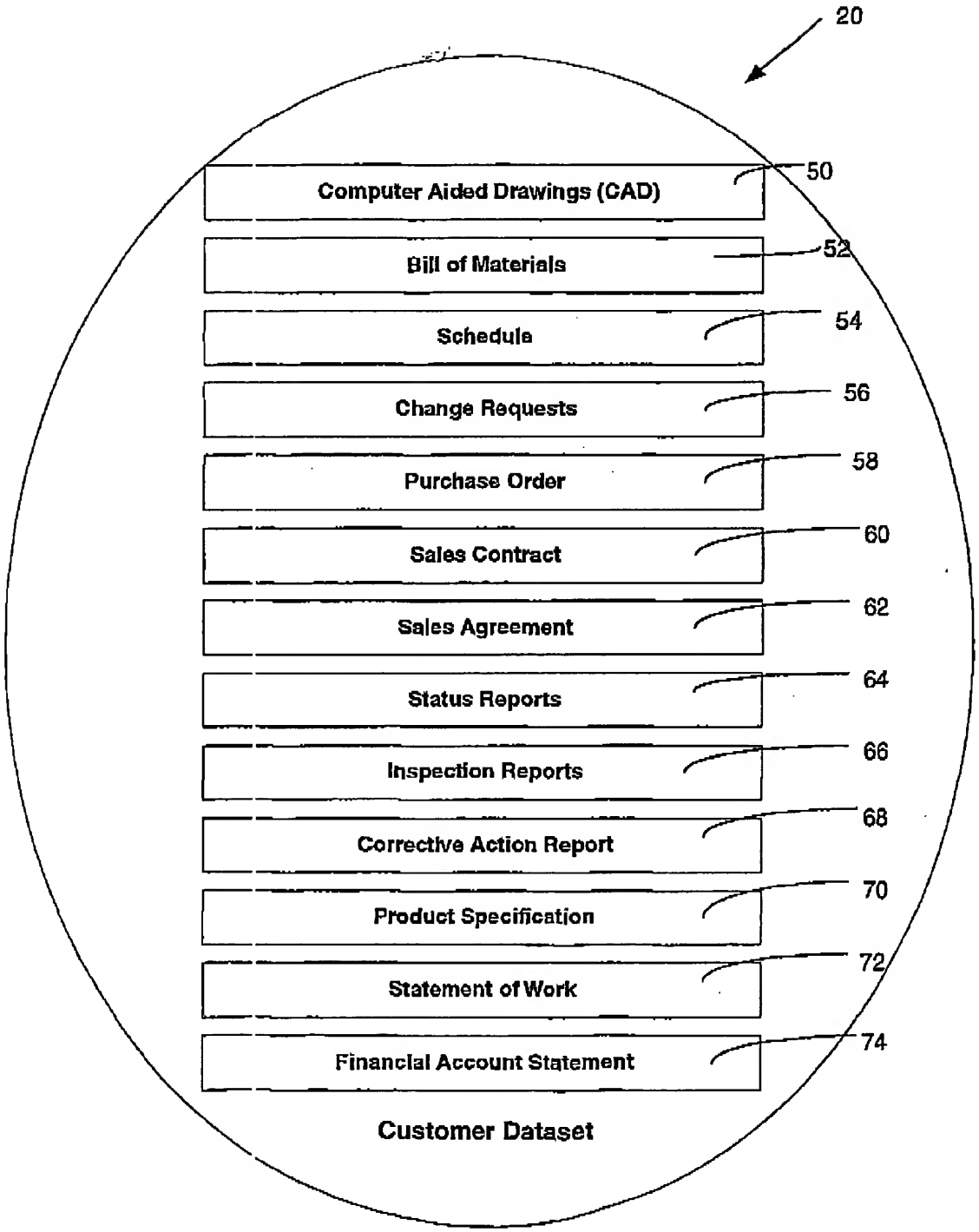
20
Computer Aided Drawings (CAD)
50
Bill of Materials
52
Schedule
54
Change Requests
56
Purchase Order
58
Sales Contract
60
Sales Agreement
62
Status Reports
64
Inspection Reports
66
Corrective Action Report
68
Product Specification
70
Statement of Work
72
Financial Account Statement
74
Customer Dataset

FIG. 3

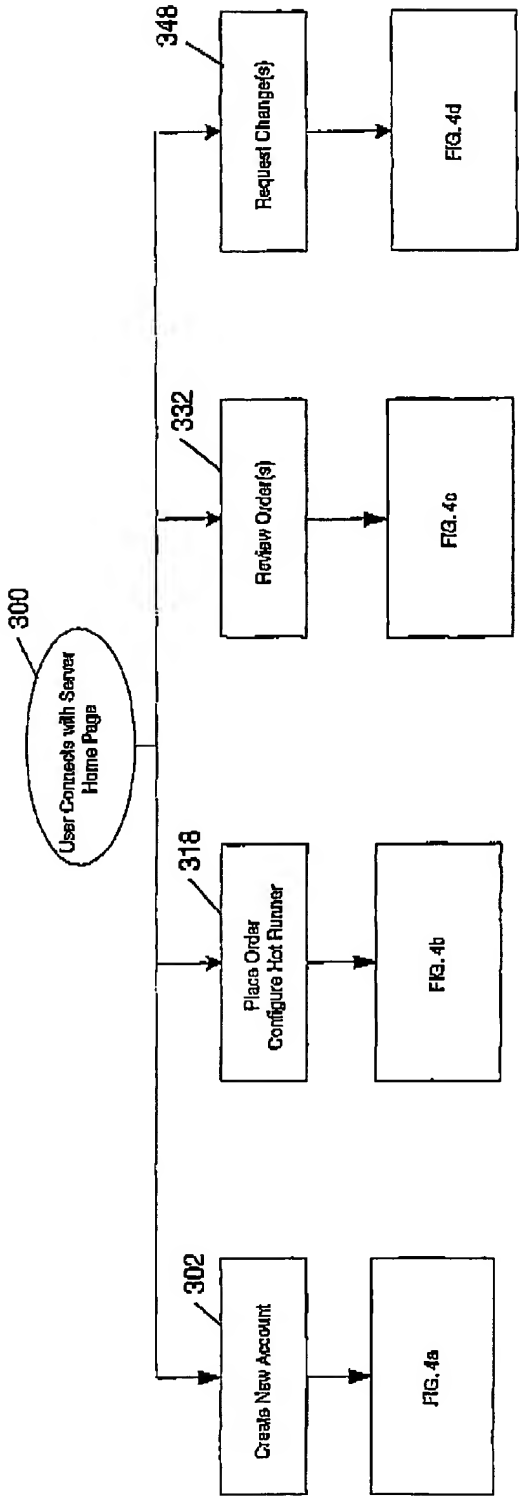
300
User Connects with Server Home Page
302
Create New Account
FIG. 4a
318
Place Order Configure Hot Runner
FIG. 4b
332
Review Order(s)
FIG. 4c
348
Request Change(s)
FIG. 4d

FIG. 4

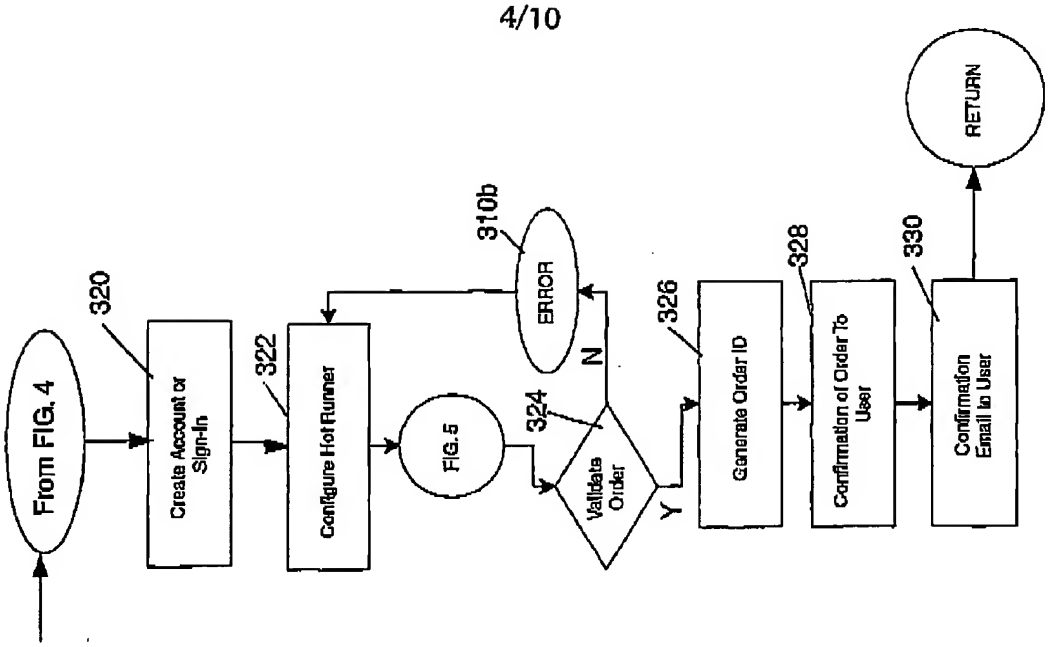
From FIG. 4
320
Create Account or Sign-In
322
Configure Hot Runner
FIG. 5
324
Validate Order
N
310b
ERROR
Y
326
Generate Order ID
328
Confirmation of Order To User
330
Confirmation Email to User
RETURN

FIG. 4b

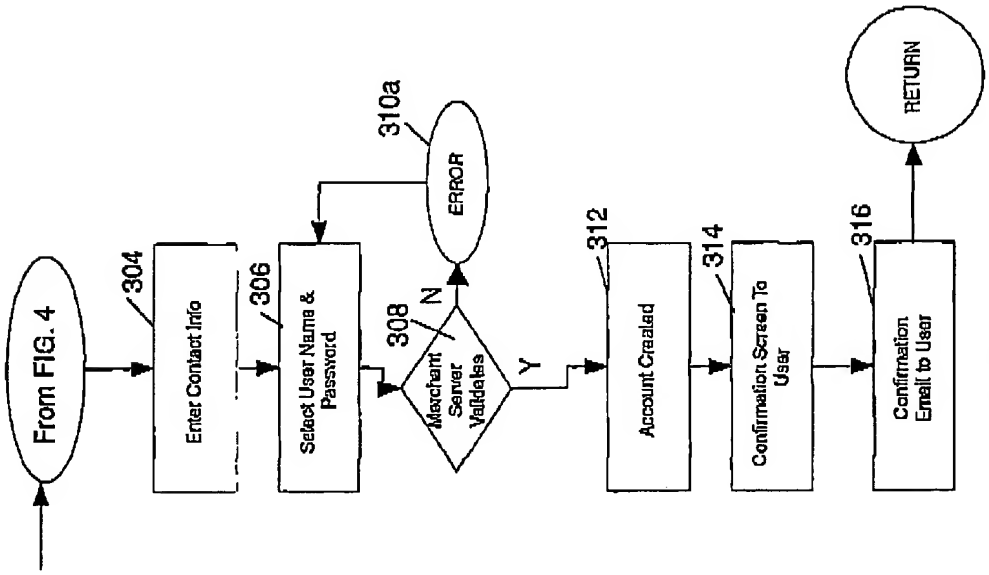
From FIG. 4
304
Enter Contact Info
306
Select User Name & Password
308
Merchant Server Validates
N
310a
ERROR
Y
312
Account Created
314
Confirmation Screen To User
316
Confirmation Email to User
RETURN

FIG. 4a

5/10

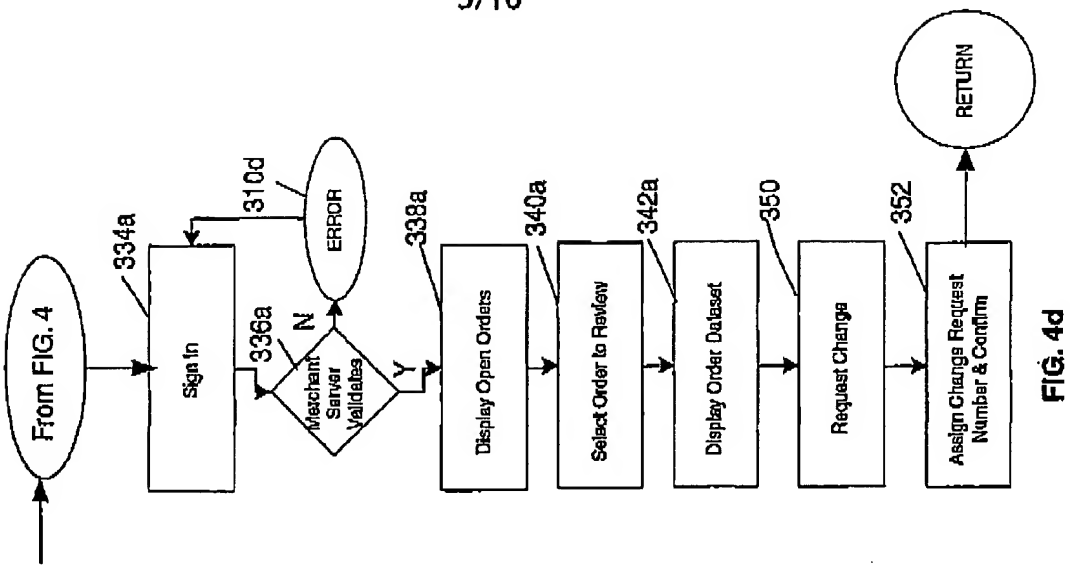

FIG. 4d

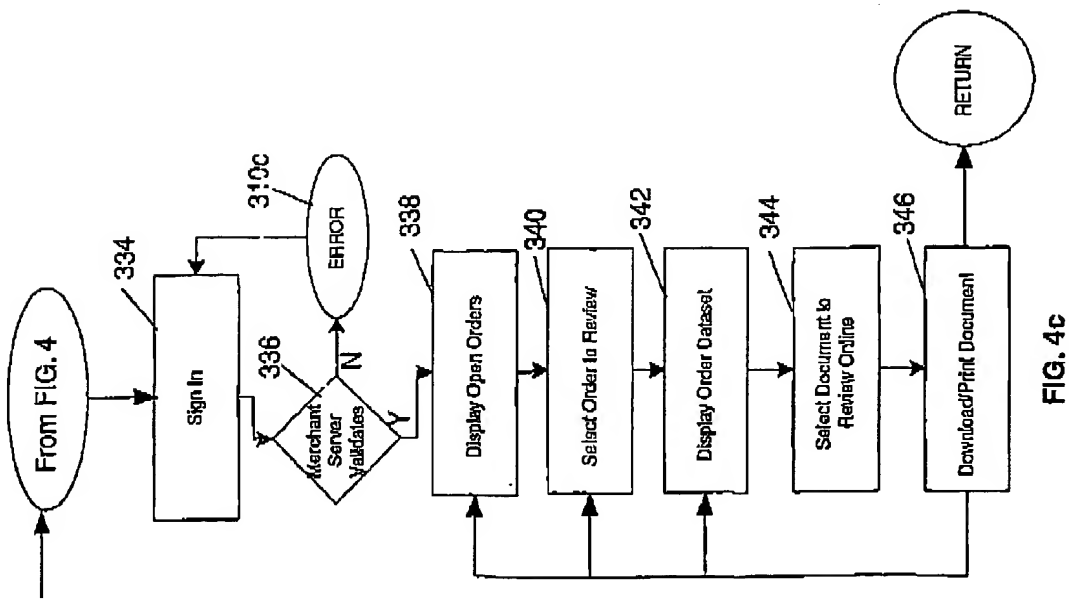

FIG. 4c

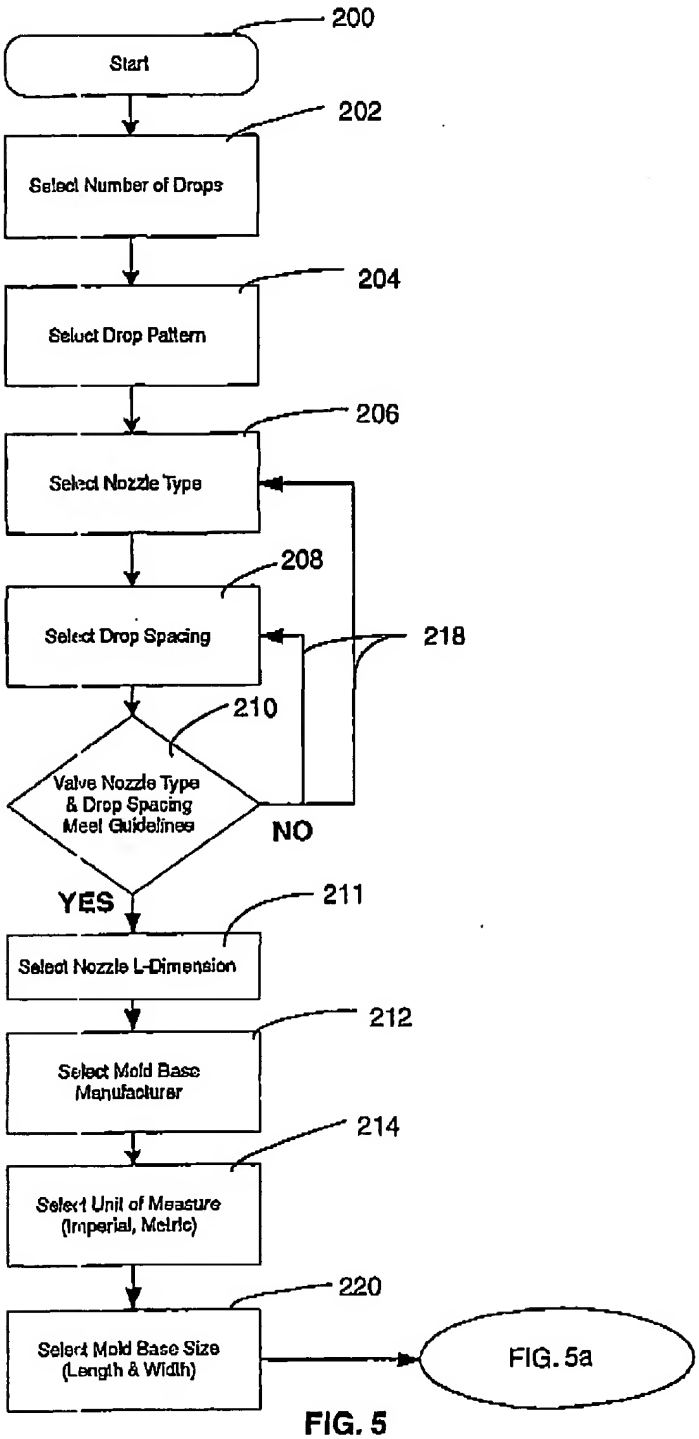
200
Start
202
Select Number of Drops
204
Select Drop Pattern
206
Select Nozzle Type
208
Select Drop Spacing
218
210
Valve Nozzle Type & Drop Spacing Meet Guidelines
NO
YES
211
Select Nozzle L-Dimension
212
Select Mold Base Manufacturer
214
Select Unit of Measure (Imperial, Metric)
220
Select Mold Base Size (Length & Width)
FIG. 5a

FIG. 5

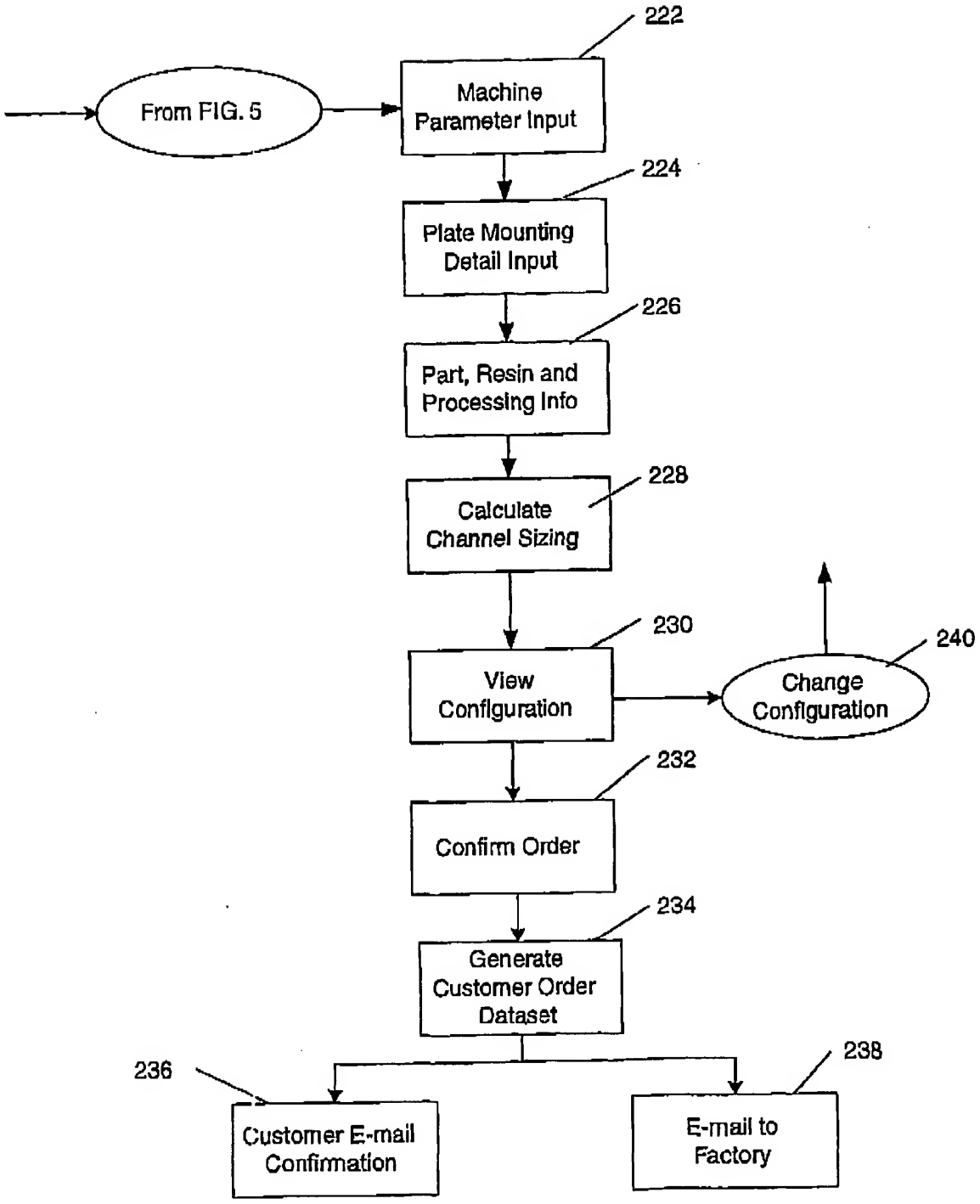
From FIG. 5
222
Machine Parameter Input
224
Plate Mounting Detail Input
226
Part, Resin and Processing Info
228
Calculate Channel Sizing
230
View Configuration
240
Change Configuration
232
Confirm Order
234
Generate Customer Order Dataset
236
Customer E-mail Confirmation
238
E-mail to Factory

FIG. 5a

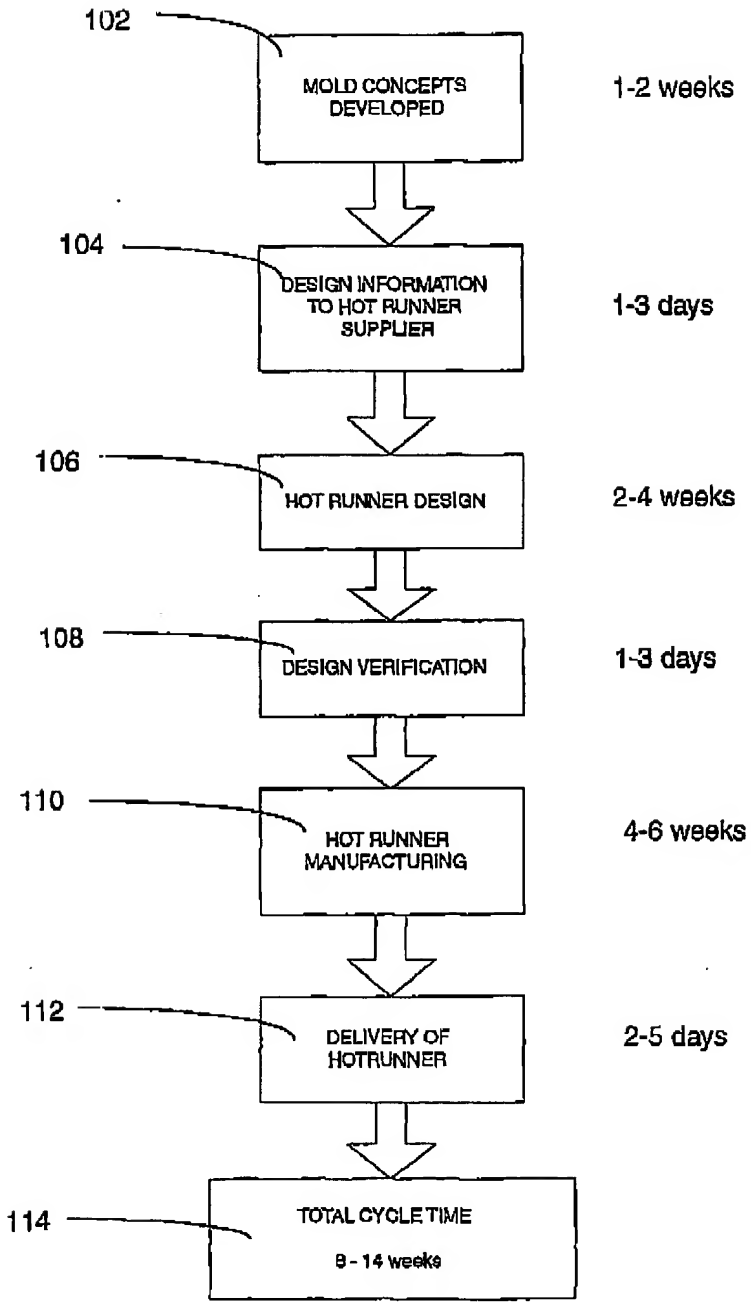

FIG. 6
PRIOR ART

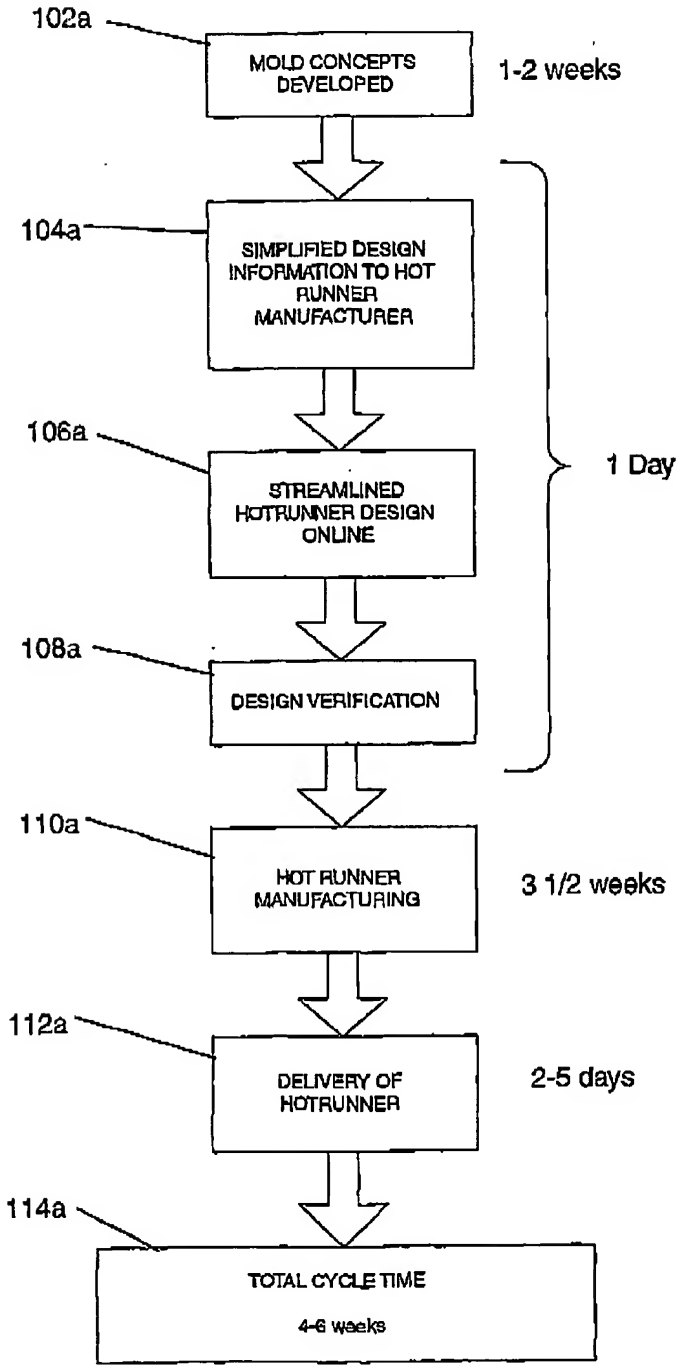
102a
MOLD CONCEPTS DEVELOPED
1-2 weeks
104a
SIMPLIFIED DESIGN INFORMATION TO HOT RUNNER MANUFACTURER
106a
STREAMLINED HOTRUNNER DESIGN ONLINE
1 Day
108a
DESIGN VERIFICATION
110a
HOT RUNNER MANUFACTURING
3 1/2 weeks
112a
DELIVERY OF HOTRUNNER
2-5 days
114a
TOTAL CYCLE TIME
4-6 weeks

FIG. 7

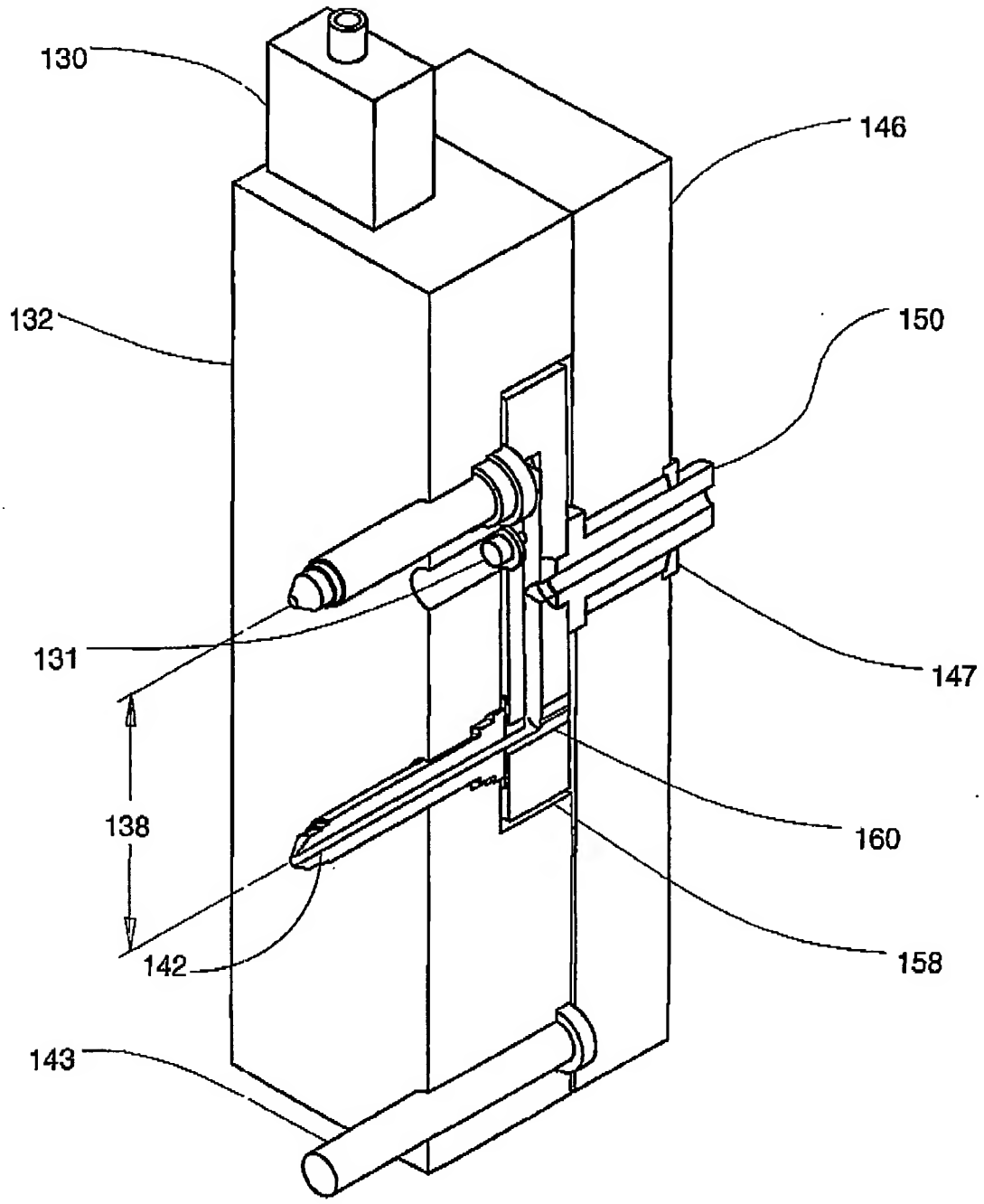

FIG. 8